Carpenter Drain
Design/Build Report

Steuben County, Indiana

June 20, 2005





Prepared by:

JFNew
708 Roosevelt Road
Walkerton, Indiana 46574
574-586-3400

Prepared for:
Crooked Lake Association, Inc.
P.O. Box 573
Angola, Indiana 46703

CARPENTER DRAIN DESIGN/BUILD REPORT
EXECUTIVE SUMMARY

JFNew stabilized approximately 200 lineal feet of streambank along Carpenter Drain within the Steuben County 4-H Park. The purpose of this project was to reduce erosion along Carpenter Drain and the delivery of eroded materials from the project site to Crooked Lake. This was accomplished by stabilizing the eroded streambanks with bioengineering techniques and removing large pieces of debris from within the channel. This project was made possible in part by the cooperation of the Crooked Lake Association and the Steuben County Commissioners. Partial funding of the project was received from the Indiana Department of Natural Resources Lake and River Enhancement (LARE) Program, the Crooked Lake Association, and the Steuben County Drainage Board.

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CARPENTER DRAIN DESIGN/BUILD REPORT
STEUBEN COUNTY, INDIANA

1.0 PROJECT DESCRIPTION AND PURPOSE

The Carpenter Drain bank stabilization project area is located on the southeast side of Crooked Lake (Figure 1). The Carpenter Drain subwatershed drains 1,987 acres (804 ha or 3.1 square miles) from its headwaters to its confluence with Crooked Lake. Carpenter Drain originates within the City of Angola industrial park then flows through predominantly agricultural and residential land. Carpenter Drain is a legal drain from its headwaters to its intersection with Interstate-69. However, the portion of Carpenter Drain in which this project is located is not a legal drain. The project area is located entirely within the Steuben County 4-H Park and is bordered by forest and forested wetland.

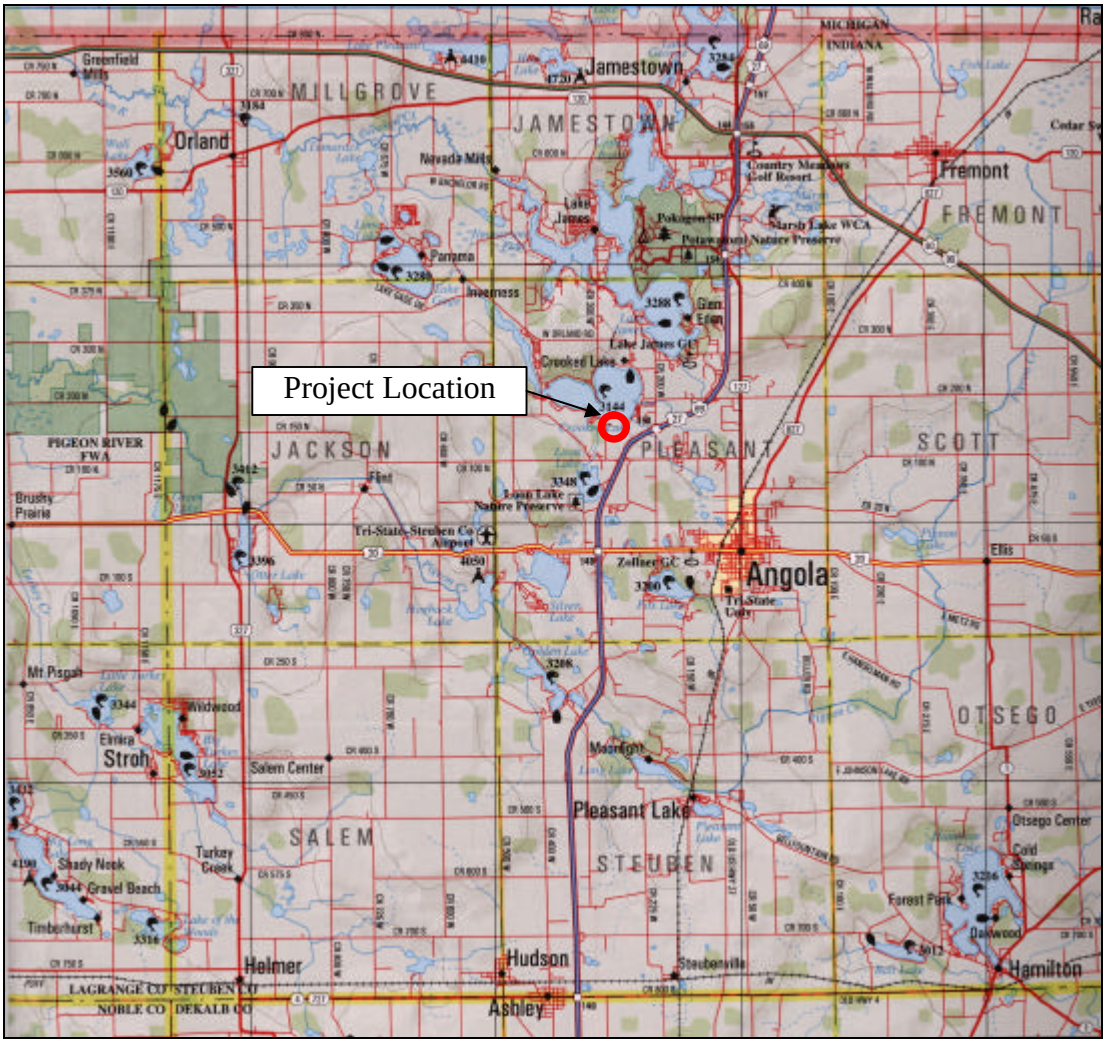


Figure 1. Approximate project location.

Carpenter Drain does not appear to have been historically dredged or straightened within the project area, and thus, remains hydrologically connected to its floodplain. The streambanks are

not uniformly steep throughout the entire reach. In places of moderate to severe erosion, they average 3-4 feet in height. The streambank erosion is likely due to anthropogenic impacts (increased non-permeable surfaces, stream channelization, etc.) within Carpenter Drain's watershed. As a result of these impacts, increased water velocity and peak flows have created additional shear stress along the streambanks. Large pieces of debris located within the stream also deflect the water's force toward the streambanks scouring the bank in several places. In some instances, the input of woody debris into the stream can be attributed to streambank failure and the subsequent collapse of trees along the bank. Figure 2 shows a representative photograph of streambank erosion occurring within the project site.

Figure 2. View of typical streambank erosion occurring within the project area.

The purpose of this project was to reduce sediment and sediment-attached pollutant delivery to Crooked Lake. This was accomplished by stabilizing the moderate to severely eroded streambanks with bioengineering techniques within the project area. Large pieces of debris, such as old culvert pipes and cross channel logjams, which were deflecting stream flows into the bank were also removed.

2.0 DESIGN RATIONALE

The Carpenter Drain project was designed to reduce streambank erosion while maintaining the aesthetic values of the natural park setting. This was accomplished by installing a series of soil encapsulated lift structures on top of a rock toe along moderate to severely eroded streambanks within the project area. A copy of the design plans can be found in Appendix A.

3.0 DESIGN AND CONSTRUCTION SPECIFICS

3.1 Landowner Agreement

The Carpenter Drain project site is located entirely within the Steuben County 4-H Park. The project design was approved by the Steuben County Commissioners during a board meeting held in January 2004.

3.2 Permitting

Regional General Permit (RGP) notifications were submitted to the U.S. Army Corps of Engineers (Corps) and Indiana Department of Environmental Management (IDEM) on May 25, 2004. An electronic permit application was submitted to the Indiana Department of Natural Resources (IDNR) for construction in a floodway on June 9, 2004. The U.S. Army Corps of Engineers issued a Regional General Permit (ID # 04-176-012-0) on August 4, 2004. No response was received from IDEM within the 15 working day waiting period thus allowing the project to proceed under the RGP. A certificate of approval for construction in a floodway (Permit # FW-22926) was received from the Indiana Department of Natural Resources on September 3, 2004. Indiana Department of Natural Resources permit correspondence can be found in Appendix B.

3.3 Streambank Stabilization

Approximately 200 lineal feet of streambank was stabilized within the project area using soil encapsulated lifts. The areas designated for treatment are displayed in Figure 3. More specific details are included in the As-Built Plans in Appendix A. Eroded streambanks that were to be treated with soil encapsulated lifts were cleared of felled trees and debris. In addition, the streambank slope was pulled back approximately two feet. The soil was stockpiled for lift construction. Rock was placed along the toe of the slope to provide a foundation (shelf) on which to construct the soil encapsulated lifts. The rock extended horizontally approximately two feet streamward of the newly constructed slope and vertically from the streambed to the ordinary high water mark on the streambank.

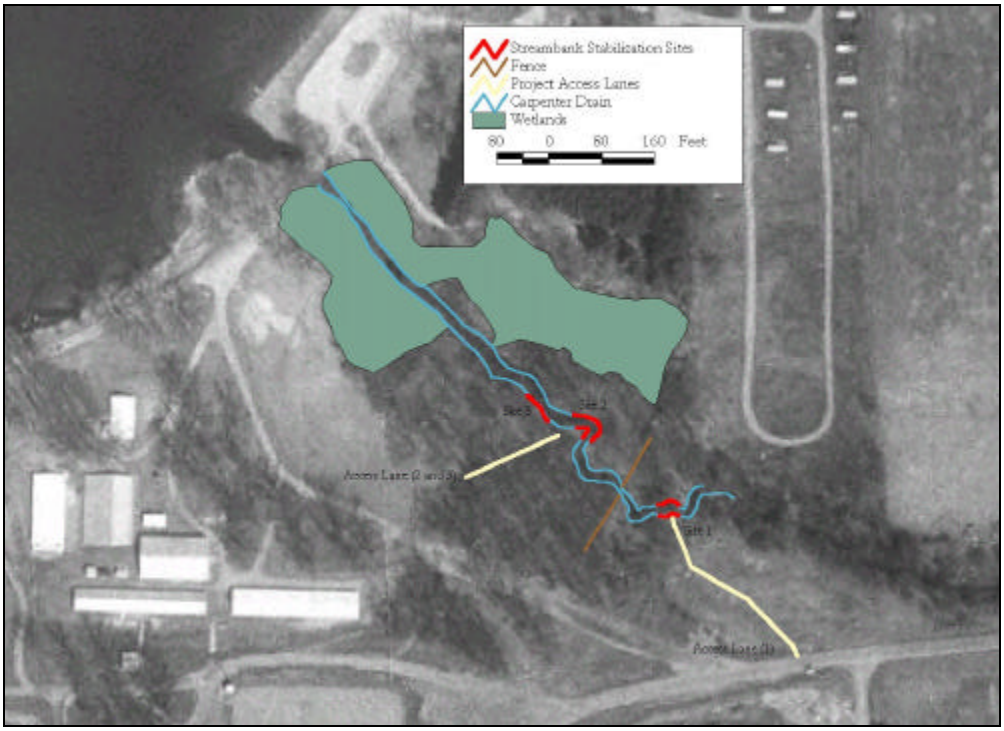


Figure 3. Streambank stabilization areas along Carpenter Drain.

A non-woven geotextile blanket was placed on top of the rock to prevent soil from being washed out from under the soil encapsulated lifts. Prefabricated lift forms were then placed on top of the

rock foundation and non-woven geotextile blanket. Bare root silky dogwood (*Cornus amomum*) shrubs were placed beneath the forms with the tops protruding out towards the stream. The silky dogwood root masses were then covered with soil. A roll of heavy, woven coconut fabric blanket (Dekowe) was rolled out over the forms parallel to the shoreline. Approximately two feet of the blanket overlapped the prefabricated lift forms landward while the remaining width of blanket hung out towards the stream. Soil was placed in the void between the lift forms and streambank, compacted by hand, and then planted along the exposed faces with a wooded wetland seed mix. (See Appendix C for seed mix species.) The fabric extending out towards the stream was then folded back over the compacted soil and secured in place with oak stakes and six-inch metal sod staples. The fabric was keyed in along the tip of the slope to prevent soil and seed from being washed from under the blanket. The prefabricated lift forms were then removed. This procedure was repeated as necessary until the lift(s) matched the grade along the top of the bank slope. Figure 4 shows a typical completed soil encapsulated lift structure along the Carpenter Drain project area. In this case, only a single lift was needed to match the surrounding landscapes grade.

Figure 4. Typical view of streambank stabilization on the Carpenter Drain project site.

4.0 CONSTRUCTION SCHEDULE

The Carpenter Drain project area was surveyed by Rowland Associates, Inc. in December 2004 as part of the design and planning process. JFNew began construction on March 22, 2005 with favorable site conditions. Construction was completed on March 25, 2005. No weather delays were encountered during construction.

5.0 MONITORING AND MAINTENANCE ACTIVITY

A member of the Crooked Lake Association or County Parks Department should monitor the project site on an annual basis for the next three to five years. At a minimum, the project area should be inspected in late spring or early summer following a storm flow event. Monitoring should include the inspection of bank stabilization areas for any failures. Potential failure of streambank stabilization measures may include portions of the erosion control blankets being

torn away from the soil surface, displacement of the rock toe, or rill erosion under the blanket caused by overland flow. If any of these situations are noted during the inspection, the person conducting the monitoring should contact JFNew. Other monitoring activities should include the inspection of plantings along the streambanks treated with erosion control blanket. If large barren patches, approximately one square yard, are noted along the erosion control blanket, they should be reseeded with an appropriate seed mix.

6.0 PROJECT SUMMARY

Increased water velocity and peak flows resulting from anthropogenic impacts within the Carpenter Drain watershed caused moderate to severe streambank within the project site. The purpose of this project was to reduce erosion along Carpenter Drain and delivery of eroded materials from the project site to Crooked Lake. This was accomplished by stabilizing approximately 200 lineal feet of eroded streambank with bioengineering techniques and removal of large pieces of debris within the channel. Construction was completed on March 25, 2005. Monitoring of the project site is recommended for the next three to five years.

APPENDIX A
Site Plan & Design Details
(As-Built)

JFNew
http://www.jfnew.com

Corporate Office
708 Roosevelt Road
Walkerton, Indiana 46574
574-586-3400 fax 574-586-3446

Cincinnati Office
8080 Beckett Center Dr., Suite 226
West Chseter, Ohio 45069
513-942-3446 fax 513-942-3447

Illinois Office
1378 Main Street
Crete, Illinois 60417
708-367-1130 fax 708-367-1132

Indianapolis Office
6640 Parkdale Place, Suite S
Indianapolis, Indiana 46254
317-388-1982 fax 317-388-1986

Michigan Office
600 South Beacon
Grand Haven, Michigan 49417
616-847-1680 fax 616-847-9970

CARPENTER DRAIN BANK STABILIZATION PROJECT

STEUBEN COUNTY, INDIANA

JANUARY 2005

INDEX OF DRAWINGS

PROJECT LOCATION

VICINITY MAP

N

ANDREW L BENDER
REGISTERED
No. 10100192
STATE OF INDIANA
PROFESSIONAL ENGINEER

REVISIONS:

Our mission is to provide the highest quality environmental services to our clients while positively impacting the lives of our employees and the conservation of natural resources through prosperity and stewardship.

JFNew

Carpenter Drain Bank Stabilization
4-H Fairgrounds
Steuben County, Indiana
TITLE SHEET AND SHEET INDEX

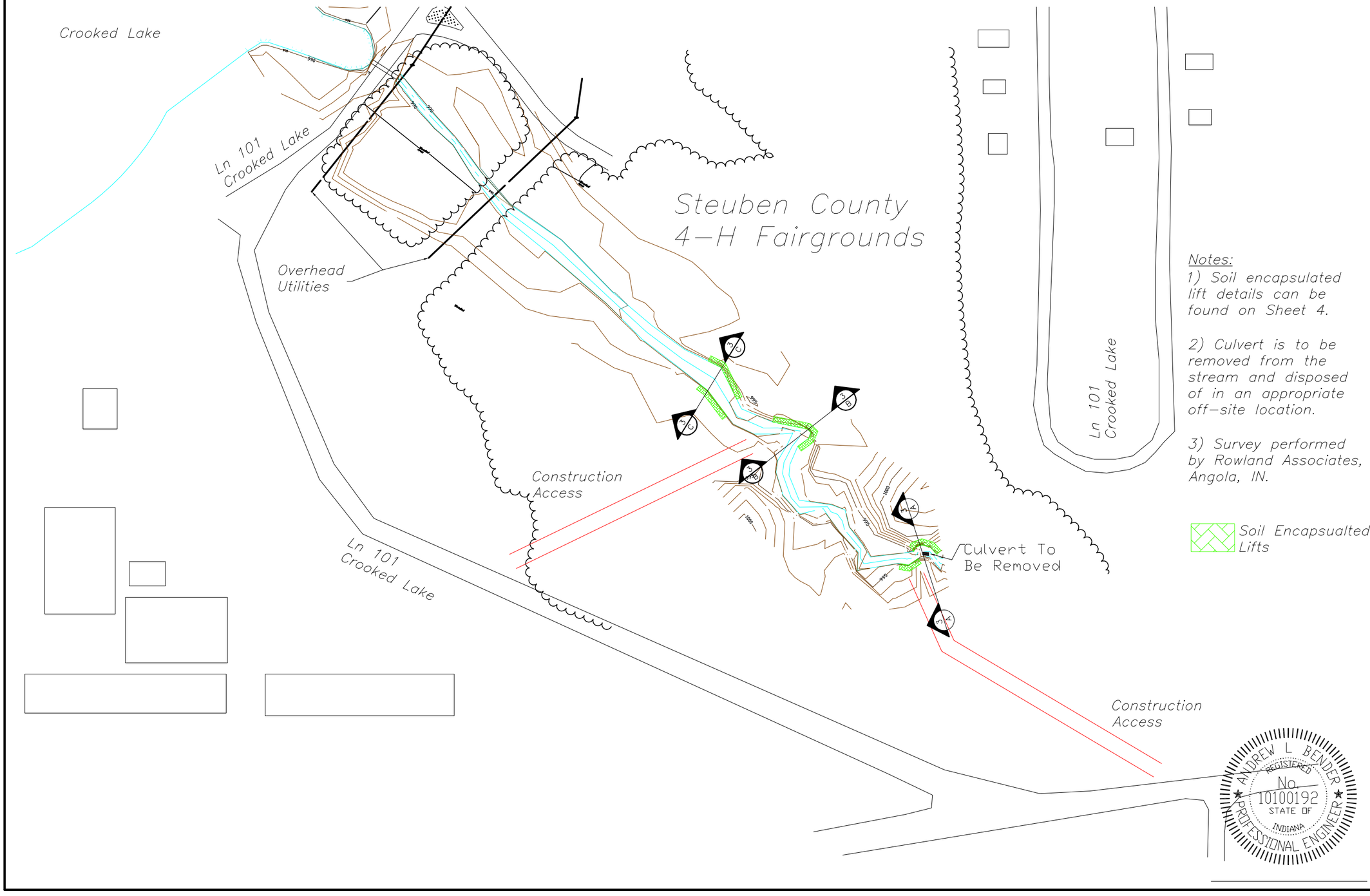
DRAWN BY:	JAE
DESIGNED BY:	JBR
CHECKED BY:	
DATE:	JAN 2005
JOB NO:	03-01-10-02
SCALE:	AS NOTED

01-COVER.DWG

DRAWING NO.

1

OF 4



N

0 50'

SCALE IN FEET

SCALE VERIFICATION
This bar measures 1" on 22"x34" or 1/2" on 11"x17" original. Adjust scale accordingly.

Corporate Office
708 Roosevelt Road
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Grand Haven, Michigan 49417
616-847-1680 fax 616-847-9670

JFNew

Carpenter Drain Bank Stabilization
4-H Fairgrounds
Steuben County, Indiana
SITE PLAN

DRAWN BY:	JAE
DESIGNED BY:	JR
CHECKED BY:	
DATE:	JAN 2005
JOB NO:	03-01-10-02
SCALE:	AS NOTED

ANDREW L BENDER
REGISTERED
No. 10100192
STATE OF INDIANA
PROFESSIONAL ENGINEER

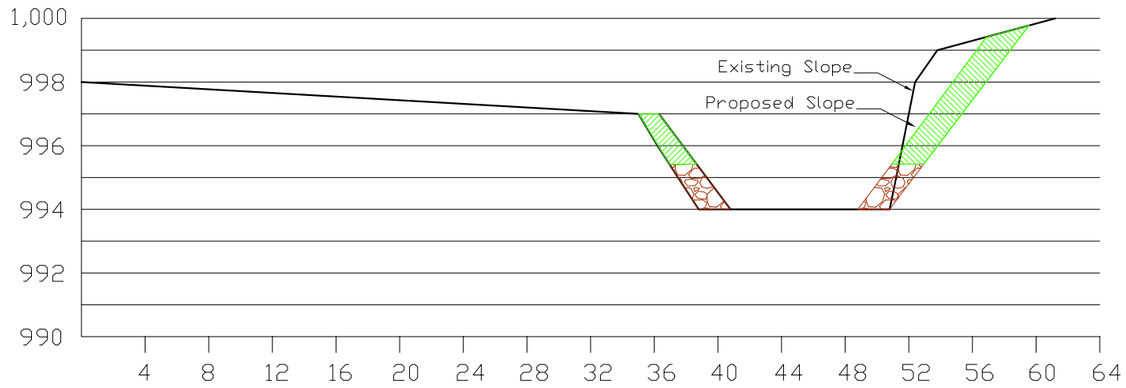
02-SITE PLAN.DWG

DRAWING NO.

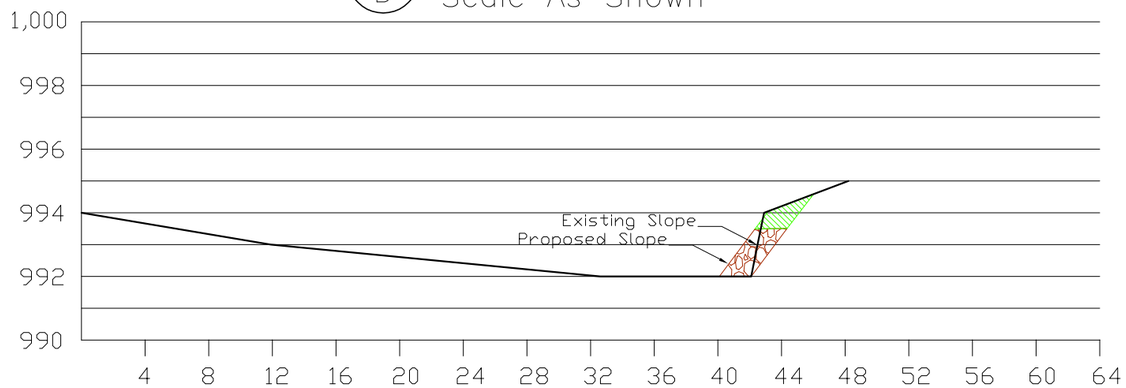
2

OF 4

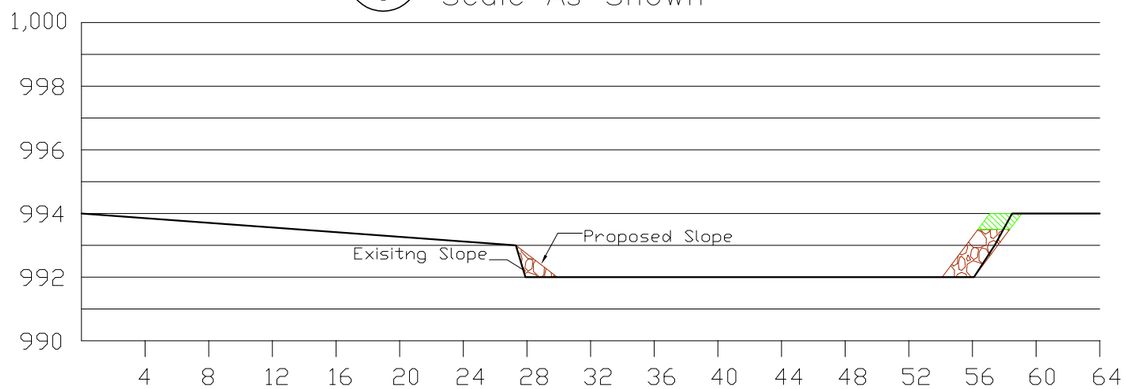
3/A Stream Cross Section
Scale As Shown



3/B Stream Cross Section
Scale As Shown



3/C Stream Cross Section
Scale As Shown



Key

Rock toe (6-12" dia. fieldstone)

Soil encapsulated lift treatement (see Sheet 4 details)

Note: See details of typical soil encapsulated lift treatment on Sheet 4.

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JFNew

Carpenter Drain Bank Stabilization
4-H Fairgrounds
Steuben County, Indiana
CROSS SECTIONS

DRAWN BY:	JAE
DESIGNED BY:	JR
CHECKED BY:	
DATE:	JAN 2005
JOB NO:	03-01-10-02
SCALE:	AS NOTED

03-CROSS SECTION.DWG

DRAWING NO.

3

OF 4

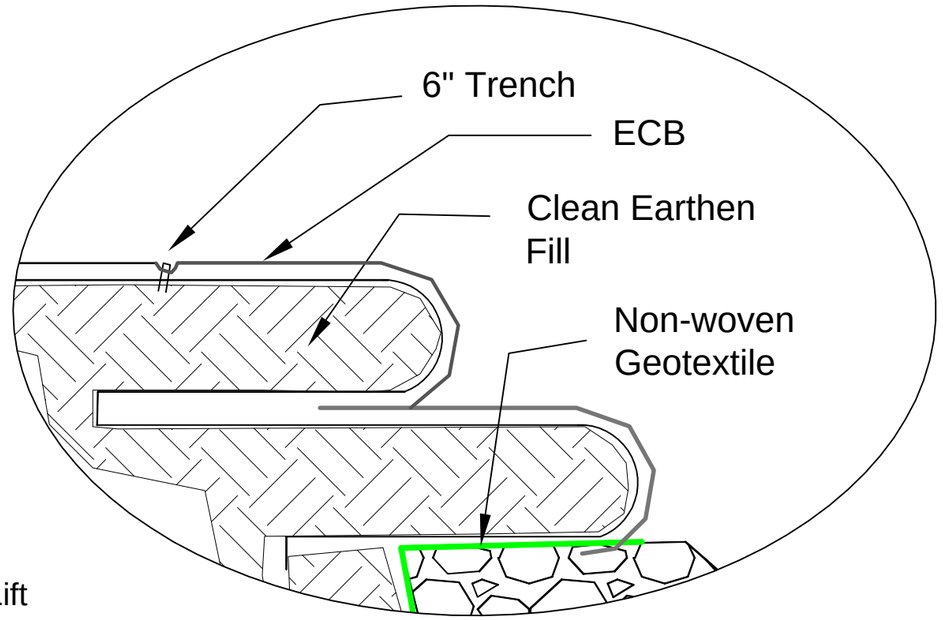
Seed Mix:

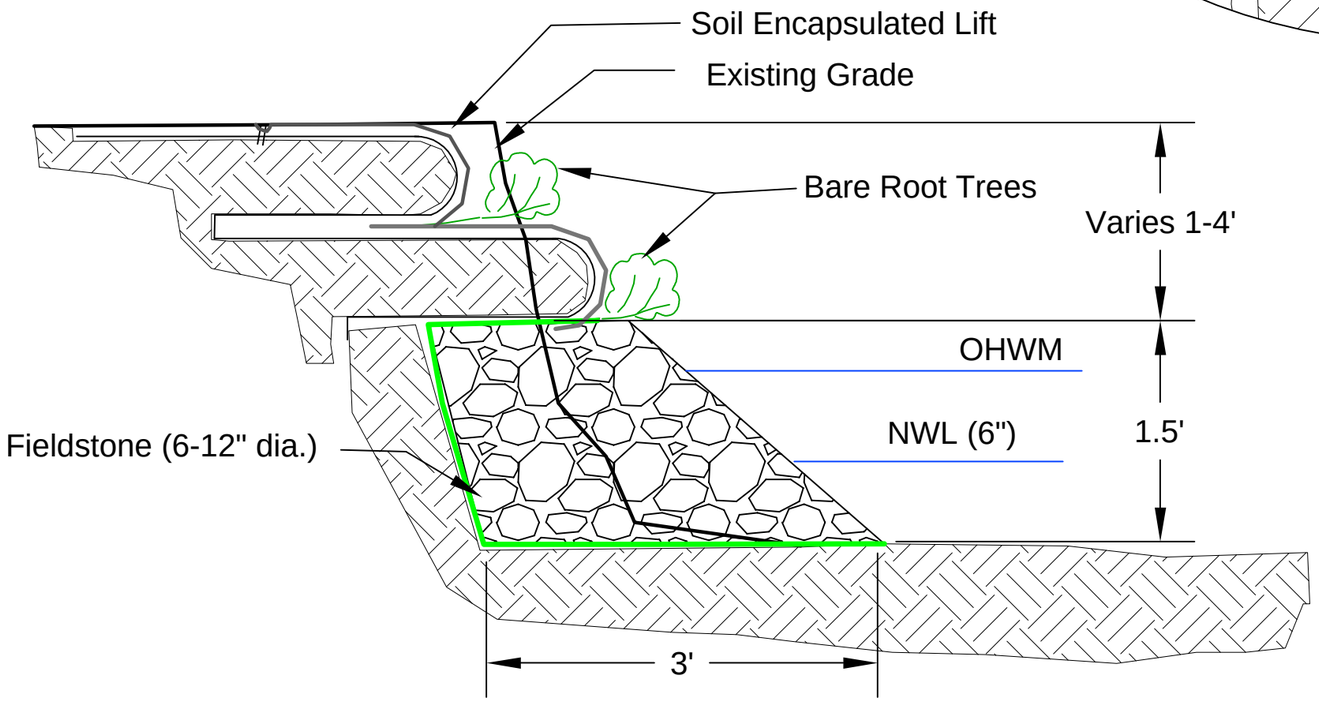
Permanent Grasses/Sedges
Blue Joint Grass (*Calamagrostis canadensis*)
Fringed Sedge (*Carex crinita*)
Porcupine Sedge (*Carex hystericinia*)
Common Hop Sedge (*Carex lupulina*)
Brown Fox Sedge (*Carex vulpinoidea*)
Prairie Wild Rye (*Elymus canadensis*)
Virginia Wild Rye (*Elymus virginicus*)
Fowl Manna Grass (*Glyceria striata*)
Rice Cut Grass (*Leersia oryzoides*)
Switch Grass (*Panicum virgatum*)
Green Bulrush (*Scirpus atrovirens*)

Temporary Cover
Redtop (*Agrostis alba*)
Seed Oats (*Avena sativa*)
Annual Rye (*Lolium multiflorum*)
Timothy (*Phleum pratense*)

Forbs
Wingstem (*Actinomeris alternifolia*)
Water Plantain (*Alisma spp.*)
Flat-top Aster (*Aster umbellatus*)
Nodding Bur Marigold (*Bidens cernua*)
Turtlehead (*Chelone glabra*)
Sneezeweed (*Helenium autumnale*)
Great Blue Lobelia (*Lobelia siphilitica*)
Monkey Flower (*Mimulus ringens*)
Cut-leaf Coneflower (*Rudbeckia laciniata*)

Bare Root Trees:
Silky Dogwood (*Cornus amomum*)





Note:
1) Bare root trees on 2' centers along each layer of lift.

2) Non-woven goetextile to be 7 oz./sq. yd.

3) Erosion Control Blanket (ECB) to be Dekowe 900 or equivalent. Three meter width.

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JFNew

Carpenter Drain Bank Stabilization
4-H Fairgrounds
Steuben County, Indiana

SOIL ENCAPSULATE LIFT DETAIL

DRAWN BY:	JAE
DESIGNED BY:	JR
CHECKED BY:	
DATE:	JAN 2005
JOB NO:	03-01-10-02
SCALE:	AS NOTED

04-LIFT.DWG

DRAWING NO.

4

OF 4

APPENDIX B
Permit Correspondence

STATE OF INDIANA
DEPARTMENT OF NATURAL RESOURCES

MAILED SEP 0 3 2004

CERTIFICATE OF APPROVAL
CONSTRUCTION IN A FLOODWAY

APPLICATION # : FW-22926

STREAM : Unnamed Tributary Crooked Lake

APPLICANT : Crooked Lake Association
Keith Hoskins
801 West Coliseum Boulevard
Fort Wayne, IN 46808-1219

AGENT : JF New & Associates, Inc
Joe Exl
708 Roosevelt Road
Walkerton, IN 46574-1220

AUTHORITY : IC 14-28-1 with 312 IAC 10

DESCRIPTION : Approximately 200' of eroded streambank, along 4 different locations, will be re-graded and stabilized with approximately 100 cubic yards of glacial stone. Soil encapsulated lifts will be placed along the top of the glacial stone wall and will be planted with native grasses and shrubs to provide additional bank stabilization. The new glacial stone wall will have a maximum height of 3' with a 1.5:1 slope. The base of the wall will project streamward approximately 1' beyond the existing bank. Details of the project are contained in information received electronically at the Division of Water on June 9, 2004 and in information received at the Division of Water on June 16, 2004.

LOCATION : DOWNSTREAM: The 4-H Fairgrounds; beginning approximately 400' southeast of Crooked Lake and continuing upstream approximately 400' near Angola, Pleasant Township, Steuben County
NE¼, SW¼, NE¼, Section 16, T 37N, R 13E, Angola West Quadrangle
UTM Coordinates: Downstream 4614577 North, 663564 East
UPSTREAM: SW¼, SW¼, NE¼, Section 16, T 37N, R 13E
UTM Coordinates: Upstream 4614508 North, 663671 East

APPROVED BY : James J. Hebenstreit

James J. Hebenstreit, P.E., Assistant Director
Division of Water

APPROVED ON : September 3, 2004

Attachments: Notice Of Right To Administrative Review
General Conditions
Special Conditions
Service List

STATE OF INDIANA
DEPARTMENT OF NATURAL RESOURCES

NOTICE OF RIGHT TO ADMINISTRATIVE REVIEW

APPLICATION #: FW- 22926

This signed document constitutes the issuance of a permit by the Department of Natural Resources, subject to the conditions and limitations stated on the pages entitled "General Conditions" and "Special Conditions".

The permit or any of the conditions or limitations which it contains may be appealed by applying for administrative review. Such review is governed by the Administrative Orders and Procedures Act, IC 4-21.5, and the Department's rules pertaining to adjudicative proceedings, 312 IAC 3-1.

In order to obtain a review, a written petition must be filed with the Division of Hearings within 18 days of the mailing date of this notice. The petition should be addressed to:

Mr. Stephen L. Lucas, Director
Division of Hearings
Room W272
402 West Washington Street
Indianapolis, Indiana 46204

The petition must contain specific reasons for the appeal and indicate the portion or portions of the permit to which the appeal pertains.

If an appeal is filed, the final agency determination will be made by the Natural Resources Commission following a legal proceeding conducted before an Administrative Law Judge. The Department of Natural Resources will be represented by legal counsel.

STATE OF INDIANA
DEPARTMENT OF NATURAL RESOURCES

GENERAL CONDITIONS

APPLICATION #: FW- 22926

(1) If any archaeological artifacts or human remains are uncovered during construction, federal law and regulations (16 USC 470, et seq.; 36 CFR 800.11, et al) and State Law (IC 14-21-1) require that work must stop and that the discovery must be reported to the Division of Historic Preservation and Archaeology within 2 business days.

Division of Historic Preservation and Archaeology
Room W274
402 West Washington Street
Indianapolis, IN 46204

Telephone: (317) 232-1646, FAX: (317) 232-8036

(2) This permit must be posted and maintained at the project site until the project is completed.

(3) This permit does not relieve the permittee of the responsibility for obtaining additional permits, approvals, easements, etc. as required by other federal, state, or local regulatory agencies.These agencies include, but are not limited to:

Agency	Telephone Number
*US Army Corps of Engineers, Detroit District	(313) 226-2218
St. Joseph River Basin Commission	(574) 287-1829
Steuben County Drainage Board	(260) 668-1000
Indiana Department of Environmental Management	(317) 233-8488 or (800) 451-6027
Local city or county planning or zoning commission	

(4) This permit must not be construed as a waiver of any local ordinance or other state or federal law.

(5) This permit does not relieve the permittee of any liability for the effects which the project may have upon the safety of the life or property of others.

(6) This permit may be revoked by the Department of Natural Resources for violation of any condition, limitation or applicable statute or rule.

(7) This permit shall not be assignable or transferable without the prior written approval of the Department of Natural Resources. To initiate a transfer contact:

Mr. Michael W. Neyer, PE, Director
Division of Water
Room W264
402 West Washington Street
Indianapolis, IN 46204

Telephone: (317) 232-4160, Toll Free: (877) 928-3755
FAX: (317) 233-4579

(8) The Department of Natural Resources shall have the right to enter upon the site of the permitted activity for the purpose of inspecting the authorized work.

(9) The receipt and acceptance of this permit by the applicant or authorized agent shall be considered as acceptance of the conditions and limitations stated on the pages entitled "General Conditions" and "Special Conditions".

STATE OF INDIANA
DEPARTMENT OF NATURAL RESOURCES

SPECIAL CONDITIONS

APPLICATION #: FW- 22926

PERMIT VALIDITY : This permit is valid for 24 months from the "Approved On" date shown on the first page. If work has not been initiated by September 03, 2006 the permit will become void and a new permit will be required in order to continue work on the project.

This permit becomes effective 18 days after the "MAILED" date shown on the first page. If both a petition for review and a petition for a stay of effectiveness are filed before this permit becomes effective, any part of the permit that is within the scope of the petition for stay is stayed for an additional 15 days.

CONFORMANCE : Other than those measures necessary to satisfy the "General Conditions" and "Special Conditions", the project must conform to the information received by the Department of Natural Resources on: June 9, 2004 and June 16, 2004. Any deviation from the information must receive the prior written approval of the Department.

Number	Special Condition
(1)	revegetate all bare and disturbed areas with a mixture of grasses (excluding all varieties of tall fescue) and legumes as soon as possible upon completion; low endophyte tall fescue may be used in the ditch bottom and side slopes only
(2)	appropriately designed measures for controlling erosion and sediment must be implemented to prevent sediment from entering the stream or leaving the construction site; maintain these measures until construction is complete and all disturbed areas are stabilized
(3)	seed and apply mulch on all disturbed areas not protected by other methods
(4)	except for the material used as backfill as shown on the above referenced project plans on file at the Division of Water, place all excavated material landward of the floodway *
(5)	all work must conform with the existing bank at the upstream and downstream limits of the project site
(6)	do not leave felled trees, brush, or other debris in the floodway *
(7)	glacial stone placed for bank stabilization must conform to the bank
(8)	upon completion of the project, remove all construction debris from the floodway *
(9)	* Note: for regulatory purposes, the floodway is defined as the area inundated by the 100-year frequency flood as shown on Panel 25 of the County of Steuben Flood Insurance Rate Map dated July 3, 1986

APPENDIX C
Seed Mix Species List

Wooded Wetland Seed Mix

Botanical Name	Common Name	Ounces/Acre
Permanent		
Grasses/Sedges		
Calamagrostis canadensis	Blue Joint Grass	3.00
Carex crinita	Fringed Sedge	2.00
Carex hystericinia	Porcupine Sedge	4.00
Carex lupulina	Common Hop Sedge	4.00
Carex vulpinoidea	Brown Fox Sedge	6.00
Elymus canadensis	Prairie Wild Rye	6.00
Elymus virginicus	Virginia Wild Rye	12.00
Glyceria striata	Fowl Manna Grass	4.00
Leersia oryzoides	Rice Cut Grass	2.00
Panicum virgatum	Switch Grass	2.50
Scirpus atrovirens	Green Bulrush	6.00
Spartina pectinata	Prairie Cord Grass	4.00
		55.50
Temporary Cover:		
Agrostis alba	Redtop	16.00
Avena sativa	Seed oats	512.00
Lolium multiflorum	Annual rye	80.00
Phleum pratense	Timothy	60.00
		668.00
Forbs:		
Actinomeris alternifolia	Wingstem	1.00
Alisma spp.	Water Plantain	3.00
Aster umbellatus	Flat-top aster	1.25
Bidens cernua	Nodding bur marigold	3.00
Chelone glabra	Turtlehead	1.25
Helenium autumnale	Sneezeweed	1.50
Lobelia siphilitica	Great Blue Lobelia	1.50
Mimulus ringens	Monkey Flower	1.75
Rudbeckia laciniata	Cut-Leaf Coneflower	0.75
		15.00

APPENDIX D
Site Photographs

Figure 1. Streambank erosion occurring at former stream crossing of Carpenter Drain at Site 1.

Figure 2. Soil encapsulated lifts constructed at Site 1. The earthen mound used in the old crossing has been regraded to match the existing floodplain grade.

Figure 3. Upstream view of erosion occurring on the outside bend of Site 2.

Figure 4. Upstream view of Site 2 after the installation of a soil encapsulated lift.

Figure 5. Upstream view of streambank erosion occurring at Site. Note the felled trees that JFNew crews have begun to cut up for removal. These trees force stream flows into the bank during high flow events leading to erosion.

Figure 6. Upstream view of Site 3 after soil encapsulated lift construction.